Getting Started with OnScreen Particle Physics

Of course, the best way to learn to use a program is to use it. But here are some suggestions for investigations that you can do with this program.

1. How is a particle's path affected by its momentum and by a magnetic field?

- Click the *OnScreen* icon.
- Close *Particle Chamber* window.
- On menu bar choose *Trackmaker-Activate*.
  Under its pull-down menu:
  - *Select Particle*.
  - *Select Direction*.
  - *Select Speed*. Record these settings.
  - Set the magnetic field with the slider bar.
  - *Inject Particle* (*Ctrl I*).

  Vary these settings until you understand how the parameters interact.

2. How can you find the momentum of a particle in a magnetic field? How does that allow you to find the particle's mass?

- Close *Trackmaker* window.
- On the menu bar under *Show* choose *Particle Chamber* and *Chamber Controls*.
- Under *Event* choose *Particle Decay 1* or *2*.

  It will open with a box with x, y, and z (unlabeled) axes and a list of values for magnetic field **B**, kinetic energy T, and box length L. The box represents a chamber in which a particle decay takes place.

A. Click *Actions* on the menu bar and then *New Event* (*Ctrl E)* in the pull-down menu. This will cause the decay of the same kind of particle each time. Each particle has its own color trace.

1. **Two-dimensional:** You may decide to analyze an "easy" one first, that is, one that is only <u>two-dimensional</u> and shows up as a substantial section of a circle. If the image you see does not qualify, click *Actions-New Event* again until you find one.

2. **Three-dimensional:** Choose an event that has motion in all three dimensions. Find the relationship between the momentum in the x-y plane and in the z-direction.

B. Now click *Show* and then *Projection*. This screen contains a tape measure option to measure distances on the screen. (You may click to different plane views if you like.) Get enough data to get a consistent value for the radius of the circle.

C. Go to *Reminders* on the task bar. In the pull-down menu you'll find *Energy-Momentum* and *Motion* in a **B**-Field. These equations, together with what you know about **B**, T, L, and radius **R**, will give you the tools to find the mass and charge of the particle.

D. To change values of B, T, and L, go to *Show* and then the sliders on *Chamber Controls*. It will have no effect on the current tracks but will affect a new event under *Actions-New Event*.

F. Go to *Settings* and click *Slow Motion*; it will make it easier to see the particles in motion.

G. Record data and calculate the masses of your particles.